AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph at page 3, lines 2-13 with the following paragraph:

The present invention is a biasing system for a tri-layer magnetoresistive sensor. The tri-layer sensor includes a tri-layer reader stack having a first free layer, a second free layer, and a magnetoresistive/spacer layer between the first and second free layers. Magnetization rotation in the free layers occurs in response to magnetic flux from the disc and a magnetoresistive effect is produced in the magnetoresistive/spacer layer. The free layers are positioned in the tri-layer reader stack such that quiescent state/unbiased magnetizations of the free layers are substantially antiparallel. A biasing means is positioned with respect to the tri-layer reader stack, typically separated from the tri-layer reader stack by a nonmagnetic spacer layer, such that a biasing field is induced on the entire tri-layer reader stack. This biasing results in the free layers having biased magnetizations directed substantially orthogonal with respect to each other.

Please replace the paragraph at page 4, lines 2-3 with the following paragraph:

FIG. 1 shows a perspective view of a tri-layer reader stack in a quiescent/unbiased state.

Please replace the paragraph at page 6, lines 2-10 with the following paragraph:

FIG. 1 shows a perspective view of tri-layer reader stack 10 in a quiescent/unbiased state. Tri-layer reader stack 10 includes first free layer 12, magnetoresistive/spacer layer 14, and second free layer 16. Magnetoresistive/spacer layer 14 is positioned between first free layer 12 and second free layer 16. Free layers 12 and 16 are preferably made of a ferromagnetic material. Magnetoresistive/spacer layer 14 may be either a tunnel barrier (to produce a tunneling magnetoresistive, or TMR, effect) or a nonmagnetic conducting spacer (to produce a giant magnetoresistive, or GMR, effect). The quiescent state/unbiased magnetization directions of free layers 12 and 16 are denoted by the arrows 12' and 16', respectively, on each of the free layers.

Please replace the paragraph at page 6, lines 11-23 with the following paragraph:

First free layer 12 and second free layer 16 have shape anisotropy induced magnetization directions. That is, the easy axes of magnetization of first free layer 12 and second free layer 16 in a quiescent/unbiased state point in a direction based on the crystal structure of the material. First free layer 12 is positioned with respect to second free layer 16 in tri-layer reader stack 10 such that the quiescent state/unbiased magnetization directions of the free layers are generally antiparallel with respect to each other. The magnetization directions of free layers 12 and 16 can also be forced antiparallel with respect to one another by, for example, using permanent magnet biasing or incorporating a pinned antiferromagnetic layer. Magnetic alignment between first free layer 12 and second free layer 16 is also modifiable by adjusting the size and shape of the free layers. These modifications can be performed as the particular specifications of tri-layer reader stack 10 and the magnetoresistive read/write head dictate.

Please replace the paragraph at page 9, line 20 to page 10, line 20 with the following paragraph:

With bias layer 30 positioned within tri-layer reader stack 10, a biasing field is provided to both the front and the back edges of first free layer 12 and second free layer 16. As shown in FIG. 4, the biasing fields emerge from the air bearing surface (ABS) side of the bias layer 30 and return to the opposite side of bias layer 30 via free layers 12 and 16. Bias layer 30 can be positioned to alter the biasing direction with respect to tri-layer reader stack 10 as design requirements dictate. As with the conventional biasing scheme shown in FIGS. 3a and 3b, appropriate positioning of bias layer 30 relative to tri-layer reader stack 10 forces the magnetization directions of free layers 12 and 16 to align at an angle with respect to each other. Different angles between the magnetization directions of free layers 12 and 16 can be achieved by positioning bias layer 30 at different distances from tri-layer reader stack 10 (e.g., by varying a thickness of nonmagnetic spacer layer 32). Preferably, bias layer 30 is positioned such that magnetization direction 12' of first free layer 12 is biased generally orthogonal with respect to magnetization direction 16'

of second free layer 16. Nonmagnetic spacer layer 32 decouples direct exchange coupling between bias layer 30 and first free layer 12. In a preferred embodiment, nonmagnetic spacer layer 32 is made of a material that enhances specular reflection of electrons, for example a metal such as Ag and Au, or a metal oxide such as Al_2O_3 or Y_2O_3. If nonmagnetic spacer layer 32 is made of a metal oxide, current shunting through bias layer 30 is eliminated or significantly reduced for current-in-plane (CIP) type sensors. As a result, the sensitivity of the reader will increase. Furthermore, by using a material for nonmagnetic spacer layer 32 that enhances specular reflection of electrons, the magnetoresistive effect produced by magnetoresistive/spacer layer 14 is enhanced, since the mean free path of electrons passing through magnetoresistive/spacer layer 14 is reduced. Specular electron scattering in magnetoresistive devices is discussed in H.J.M. Swagten, G.J. Strijkers, R.H.J.N. Bitter, W.J.M. de Jonge, J.C.S.Kools, *Specular Reflection in Spin Valves Bounded by NiO Layers*, IEEE Transactions on Magnetics, v.34, No. 4, pp. 948-953 (1998), and is incorporated by reference.

Please replace the paragraph at page 11, line 12 to page 12, line 11 with the following paragraph:

With bias layers 40 and 42 positioned within tri-layer reader stack 10, a biasing field is provided to both the front and the back edges of first free layer 12 and second free layer 16. As shown in FIG. 5, the biasing fields emerge from the ABS of bias layers 40 and 42 and return to the opposite side of bias layers 40 and 42 via free layers 12 and 16. Bias layers 40 and 42 can be positioned to alter the biasing direction as reader requirements dictate. As with the conventional biasing scheme shown in FIGS. 3a and 3b and the biasing scheme according to the present invention shown in FIG. 4, appropriate positioning of bias layers 40 and 42 relative to tri-layer reader stack 10 forces the magnetization directions of free layers 12 and 16 to align at an angle with respect to each other. Different angles between the magnetization directions of free layers 12 and 16 can be achieved by positioning bias layers 40 and 42 at different distances from tri-layer reader stack 10 (e.g., by varying a thickness of nonmagnetic spacer layers

44 and 46). Preferably, bias layers 40 and 42 are positioned such that the magnetization direction of first free layer 12 is biased generally orthogonal to the magnetization direction of second free layer 16. Nonmagnetic spacer layer 44 decouples direct exchange coupling between bias layer 40 and first free layer 12, and nonmagnetic spacer layer 46 decouples direct exchange coupling between bias layer 42 and second free layer 16. In a preferred embodiment, nonmagnetic spacer layers 44 and 46 are made of a material that enhances specular reflection of electrons, for example a metal such as Ag and Au, or a metal oxide such as Al_2O_3 or Y_2O_3. If nonmagnetic spacer layers 44 and 46 are made of a metal oxide, current shunting through bias layer 40 is eliminated or significantly reduced for current-in-plane (CIP) type sensors. As a result, the sensitivity of the reader will increase. Furthermore, by using a material for nonmagnetic spacer layers 44 and 46 that enhances specular reflection of electrons, the magnetoresistive effect produced by magnetoresistive/<u>spacer</u> layer 14 is enhanced, since the mean free path of electrons passing through magnetoresistive/<u>spacer</u> layer 14 is reduced.

Please replace the paragraph at page 12, lines 12-22 with the following paragraph:

FIG. 6 shows tri-layer reader stack 10 having magnetic fields *H* produced by sense current *I* to provide a biasing field according to another embodiment of the present invention. Sense current leads 60 and 62 are connected to tri-layer reader stack 10 via cap layer 64 and seed layer 66, respectively. Sense current *I* is passed through sense current leads 60 and 62 and tri-layer reader stack 10 to detect a change in resistivity of the MR sensor (in conjunction with external circuitry as described above and not shown in FIG. 6). As sense current *I* passes through sense current leads 60 and 62, magnetic fields *H* are produced around sense current leads 60 and 62. Magnetic fields *H* bias free layers 12 and 16 such that magnetizations 12' and 16' of first free layer 12 and second free layer 16 rotate from their quiescent/<u>unbiased</u> antiparallel state.

Please replace the paragraph at page 16, lines 1-13 with the following paragraph:

To summarize, the present invention is a biasing system for a tri-layer reader stack magnetoresistive sensor to provide a biasing field to the entire tri-layer reader stack. The tri-layer reader stack includes a first free layer, a second free layer, and a magnetoresistive/spacer layer between the first and second free layers. Magnetization rotation in the free layers occurs in response to magnetic flux from the disc and a magnetoresistive effect is produced in the nonmagnetic layer. The free layers are positioned in the tri-layer reader stack such that quiescent state/unbiased magnetizations of the free layers are substantially antiparallel. A biasing structure is positioned with respect to the tri-layer reader stack, typically separated from the tri-layer reader stack by a nonmagnetic spacer layer. The biasing structure produces a biasing field through the tri-layer reader stack. This biasing results in the free layers having biased magnetizations directed at an angle with respect to each other, preferably generally orthogonal.